Morpholine

Other names:	1,4-oxazine, tetrahydro-
	1-Oxa-4-azacyclohexane
	2H-1,4-Oxazine, tetrahydro-
	4H-1,4-Oxazine, tetrahydro-
	BASF 238
	DIETHYLENE IMIDOXIDE
	DIETHYLENE OXIMIDE
	Diethyleneimide oxide
	Diethylenimide oxide
	Drewamine
	NA 2054
	NSC 9376
	TETRAHYDRO-P-ISOXAZINE
	Tetrahydro-1,4-isoxazine
	Tetrahydro-1,4-oxazine
	Tetrahydro-2H-1,4-oxazine
	Tetrahydro-p-oxazine
	UN 2054
	p-Isoxazine, tetrahydro-
Inchi:	InChI=1S/C4H9NO/c1-3-6-4-2-5-1/h5H,1-4H2
InchiKey:	YNAVUWVOSKDBBP-UHFFFAOYSA-N
Formula:	C4H9NO
SMILES:	C1COCCN1
Mol. weight [g/mol]:	87.12
CAS:	110-91-8

Physical Properties

Property code	Value	Unit	Source
af	0.3700		KDB
affp	924.30	kJ/mol	NIST Webbook
basg	891.20	kJ/mol	NIST Webbook
chl	-2673.60 ± 0.60	kJ/mol	NIST Webbook
dm	1.50	debye	KDB
gf	16.55	kJ/mol	Joback Method
hf	-145.42	kJ/mol	Joback Method
hfl	-186.70 ± 0.60	kJ/mol	NIST Webbook
hfus	14.45	kJ/mol	Joback Method

hvap	45.00 ± 0.40	kJ/mol	NIST Webbook
hvap	45.30 ± 0.50	kJ/mol	NIST Webbook
ie	8.91 ± 0.03	eV	NIST Webbook
ie	8.88 ± 0.05	eV	NIST Webbook
log10ws	1.06		Aqueous Solubility Prediction Method
logp	-0.394		Crippen Method
mcvol	72.210	ml/mol	McGowan Method
nfpaf	%!d(float64=3)		KDB
nfpah	%!d(float64=2)		KDB
pc	5470.00	kPa	KDB
rinpol	779.00		NIST Webbook
rinpol	810.00		NIST Webbook
rinpol	800.00		NIST Webbook
rinpol	750.00		NIST Webbook
rinpol	766.00		NIST Webbook
rinpol	779.00		NIST Webbook
rinpol	795.00		NIST Webbook
rinpol	794.00		NIST Webbook
rinpol	779.00		NIST Webbook
rinpol	749.00		NIST Webbook
rinpol	810.00		NIST Webbook
ripol	1330.00		NIST Webbook
ripol	1273.00		NIST Webbook
ripol	1303.00		NIST Webbook
ripol	1281.00		NIST Webbook
ripol	1312.00		NIST Webbook
ripol	1274.00		NIST Webbook
tb	401.24	K	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
tb	401.40	K	KDB
tc	618.00	K	KDB
tf	268.22	K	Aqueous Solubility Prediction Method
tf	268.35	K	NIST Webbook
tf	270.10 ± 0.40	K	NIST Webbook
tf	268.30 ± 0.20	K	NIST Webbook
tf	268.40	K	KDB
tf	268.35 ± 1.00	K	NIST Webbook
tf	268.00 ± 0.02	K	NIST Webbook
vc	0.253	m3/kmol	KDB
zc	0.2693290		KDB

Temperature Dependent Properties

Property code	Value	Unit	Temperature [K]	Source
cpg	126.44	J/mol×K	390.64	Joback Method
cpg	170.28	J/mol×K	536.71	Joback Method
cpg	160.16	J/mol×K	500.19	Joback Method
cpg	149.48	J/mol×K	463.68	Joback Method
cpg	138.25	J/mol×K	427.16	Joback Method
cpg	188.90	J/mol×K	609.75	Joback Method
cpg	179.86	J/mol×K	573.23	Joback Method
cpl	173.89	J/mol×K	298.00	NIST Webbook
cpl	164.80	J/mol×K	298.15	NIST Webbook
hvapt	45.30	kJ/mol	295.50	NIST Webbook
hvapt	40.80	kJ/mol	373.50	NIST Webbook
hvapt	45.60 ± 0.40	kJ/mol	288.50	NIST Webbook
hvapt	44.30	kJ/mol	328.00	NIST Webbook
hvapt	42.30	kJ/mol	380.00	NIST Webbook
hvapt	42.30	kJ/mol	359.50	NIST Webbook
pvap	27.47	kPa	361.70	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	42.47	kPa	373.84	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	45.01	kPa	375.53	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa

pvap	47.47	kPa	377.10	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	49.95	kPa	378.63	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	52.51	kPa	380.12	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	54.94	kPa	381.51	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	57.53	kPa	382.87	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	59.98	kPa	384.16	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	

pvap	62.51	kPa	385.48	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	65.04	kPa	386.71	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	67.54	kPa	387.90	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	69.99	kPa	389.05	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	72.56	kPa	390.19	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	75.03	kPa	391.28	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa

pvap	77.49	kPa	392.32	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	80.02	kPa	393.36	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	82.52	kPa	394.38	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	85.07	kPa	395.33	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	87.48	kPa	396.32	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	
pvap	90.03	kPa	397.26	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa	

pvap	92.46	kPa	398.15	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	95.07	kPa	399.11	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	97.49	kPa	399.93	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	100.01	kPa	400.78	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	101.32	kPa	401.24	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa

pvap	13.32	kPa	343.91	Isobaric phase equilibrium of morpholine + 1-decanol, volumetric properties and molar refractivity from 293.15 to 333.15 K of morpholine + 1-decanol and 1-octanol + toluene system with applications of Prigogine-Flory-Patterson theory
pvap	39.99	kPa	372.25	Isobaric phase equilibrium of morpholine + 1-decanol, volumetric properties and molar refractivity from 293.15 to 333.15 K of morpholine + 1-decanol and 1-octanol + toluene system with applications of Prigogine-Flory-Patterson theory
pvap	40.01	kPa	372.11	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	94.90	kPa	398.92	Isobaric phase equilibrium of morpholine + 1-decanol, volumetric properties and molar refractivity from 293.15 to 333.15 K of morpholine + 1-decanol and 1-octanol + toluene system with applications of Prigogine-Flory-Patterson theory

pvap	0.25	kPa	273.27	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	0.37	kPa	278.81	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	0.53	kPa	283.89	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	0.72	kPa	288.37	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	0.94	kPa	292.61	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	

pvap	1.28	kPa	297.58	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	1.33	kPa	298.21	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	1.73	kPa	302.56	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	2.29	kPa	307.58	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	
pvap	2.92	kPa	312.01	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols	

pvap	4.07	kPa	318.26	Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols
pvap	41.00	kPa	373.15	Isothermal Vapor-Liquid Equilibria for Binary Mixtures Composed of the Closely Boiling Compounds 1,2-Dimethoxybenzene and 2-Methoxyphenol with an Adducted Agent: tert-Butanol or Morpholine
pvap	57.60	kPa	383.15	Isothermal Vapor-Liquid Equilibria for Binary Mixtures Composed of the Closely Boiling Compounds 1,2-Dimethoxybenzene and 2-Methoxyphenol with an Adducted Agent: tert-Butanol or Morpholine
pvap	79.00	kPa	393.15	Isothermal Vapor-Liquid Equilibria for Binary Mixtures Composed of the Closely Boiling Compounds 1,2-Dimethoxybenzene and 2-Methoxyphenol with an Adducted Agent: tert-Butanol or Morpholine
pvap	2.33	kPa	308.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K

pvap	3.13	kPa	313.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	5.17	kPa	323.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	6.59	kPa	328.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	8.28	kPa	333.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	12.93	kPa	343.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	15.93	kPa	348.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	37.52	kPa	370.28	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa

pvap	28.71	kPa	363.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	34.50	kPa	368.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	41.04	kPa	373.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	57.60	kPa	383.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	79.04	kPa	393.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
pvap	34.95	kPa	368.27	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	32.49	kPa	366.23	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa

pvap	30.02	kPa	364.05	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	24.96	kPa	359.12	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	22.57	kPa	356.46	Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa
pvap	66.66	kPa	387.57	Isobaric phase equilibrium of morpholine + 1-decanol, volumetric properties and molar refractivity from 293.15 to 333.15 K of morpholine + 1-decanol and 1-octanol + toluene system with applications of Prigogine-Flory-Patterson theory
pvap	19.49	kPa	353.15	Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K
rfi	1.45500		293.15	Experimental Binary VLE Data of Morpholine with 1-Butanol and 3-Methyl-1-butanol Systems

rhol	965.90	kg/m3	333.15	Densities and Excess and Partial Molar Volumes of Aqueous Pyrrolidine at 25 and 50 C and Aqueous Morpholine at 25 and 60 C
rhol	996.00	kg/m3	298.15	Densities and Excess and Partial Molar Volumes of Aqueous Pyrrolidine at 25 and 50 C and Aqueous Morpholine at 25 and 60 C
rhol	1000.00	kg/m3	293.00	KDB
srf	0.03	N/m	328.15	Surface Thermodynamics of Aqueous Solutions of Morpholine and Methylmorpholine
srf	0.04	N/m	308.15	Surface Thermodynamics of Aqueous Solutions of Morpholine and Methylmorpholine
srf	0.04	N/m	298.15	Surface Thermodynamics of Aqueous Solutions of Morpholine and Methylmorpholine
srf	0.04	N/m	318.15	Surface Thermodynamics of Aqueous Solutions of Morpholine and Methylmorpholine

Correlations

Information	Value
Property code	pvap
Equation	ln(Pvp) = A + B/(T + C)
Coeff. A	1.25144e+01
Coeff. B	-3.04377e+03
Coeff. C	-4.86400e+01

Temperature range (K), min.	270.05
Temperature range (K), max.	471.21

Information	Value
Property code	pvap
Equation	ln(Pvp) = A + B/T + C*ln(T) + D*T^2
Coeff. A	6.44713e+01
Coeff. B	-7.16809e+03
Coeff. C	-7.09931e+00
Coeff. D	3.52998e-06
Temperature range (K), min.	270.05
Temperature range (K), max.	618.00

Sources

Molar excess enthalpy (Hm E) for systems of aqueous piperazine derivatives:	https://www.doi.org/10.1016/j.jct.2015.06.006
Experimental Measurements and Correlations of Excess Molar Enthalpies for the Binary and Ternary Mixtures of (Cyclohexane, Tetrahydropyran, and Morpholine) or (Cyclohexane, 1,4-Dioxane, and Morpholine) at 308.15 K and Atmospheric Pressure:	https://www.doi.org/10.1021/je9010097
Surface Thermodynamics of Aqueous Solutions of Morpholine and Methylmorpholine:	https://www.doi.org/10.1021/je0340250
Vapor Pressure and Its Temperature Dependence of 28 Organic Compounds: Cyclic Amines, Cyclic Ethers, and Cyclic and Open Chain Secondary Alcohols:	https://www.doi.org/10.1021/acs.jced.6b00576
Isobaric vapor-liquid equilibria for binary and ternary mixtures with cyclohexane, cyclohexene, and morpholine at 100 kPa:	https://www.doi.org/10.1016/j.fluid.2010.04.008
The Yaws Handbook of Vapor Pressure:	https://www.sciencedirect.com/book/9780128029992/the-yaws-handbook-of-vapor-pressure
KDB:	https://www.cheric.org/files/research/kdb/mol/mol1466.mol
Solubility Measurement, Modeling, and Thermodynamic Functions for para-Methoxyphenylacetic Acid in Pure and Mixed Organic and Aqueous Systems:	https://www.doi.org/10.1021/acs.jced.8b00271
Experimental Binary VLE Data of Morpholine with 1-Butanol and 2-Methyl-1-butanol Systems:	https://www.doi.org/10.1021/acs.jced.7b01128
Crippen Method:	http://pubs.acs.org/doi/abs/10.1021/ci990307l
Vapor Pressures of Morpholine, Diethyl Methylmalonate, and Five Glycol Ethers at Temperatures up to 473.15 K:	https://www.doi.org/10.1021/je049627d
Experimental Measurements and Correlations of Excess Molar Enthalpies for the Binary and Ternary Mixtures of (Cyclohexane, 1,4-Dioxane and Piperidine) or (Cyclohexane, Morpholine and Piperidine) at 308.15 K and Atmospheric Pressure:	https://www.doi.org/10.1021/je500088z
Aqueous Solubility Prediction Method:	http://onschallenge.wikispaces.com/file/view/AqueousDataset002.xlsx/351826032/AqueousDa
Liquid Phase Equilibria for Mixtures of (Water + Morpholine + Ethyl Nonanoate, Diethyl Phthalate, or Isoamyl Alcohol) at 298.15 K:	https://www.doi.org/10.1021/je1000022
KDB Vapor Pressure Data:	https://www.cheric.org/research/kdb/hcprop/showprop.php?cmpid=1466
McGowan Method:	http://link.springer.com/article/10.1007/BF02311772
Joback Method:	https://en.wikipedia.org/wiki/Joback_method
Isothermal Vapor-Liquid Equilibria for Binary Mixtures Composed of the Closely Boiling Compounds 1,2-Dimethoxybenzene and 2-Methoxyphenol with an Adducted Agent, tert-Butanol or Morpholine:	https://www.doi.org/10.1021/je0302349
NIST Webbook:	http://webbook.nist.gov/cgi/cbook.cgi?ID=C110918&Units=SI
Isobaric phase equilibrium of morpholine + 1-decanol, volumetric properties and molar refractivity from 293.15 to 333.15 K of morpholine + 1-decanol and 1-octanol + toluene:	https://www.doi.org/10.1016/j.tca.2016.12.010
Liquid-Liquid Equilibria for the Ternary Systems of 4-Methyl-1,3-dioxolan-2-one + Morpholine + Octane, Decane, or Dodecane at 313.15 K or 298.15 K:	https://www.doi.org/10.1021/je401056v
Densities and Excess and Partial Molar Volumes of Aqueous Pyrrolidine at 25 [illegible]	https://www.doi.org/10.1021/je020191g
KDB (Korean Thermophysical Properties Databank):	https://www.cheric.org/research/kdb/hcprop/showprop.php?cmpid=1466
Phase Equilibria in Systems of Morpholine, Acetonitrile, and n-Alkanes:	https://www.doi.org/10.1021/acs.jced.5b00175

Legend

af:	Acentric Factor
affp:	Proton affinity
basg:	Gas basicity
chl:	Standard liquid enthalpy of combustion
cpg:	Ideal gas heat capacity
cpl:	Liquid phase heat capacity
dm:	Dipole Moment
gf:	Standard Gibbs free energy of formation
hf:	Enthalpy of formation at standard conditions
hfl:	Liquid phase enthalpy of formation at standard conditions
hfus:	Enthalpy of fusion at standard conditions
hvap:	Enthalpy of vaporization at standard conditions
hvapt:	Enthalpy of vaporization at a given temperature
ie:	Ionization energy
log10ws:	Log10 of Water solubility in mol/l
logp:	Octanol/Water partition coefficient
mcvol:	McGowan's characteristic volume
nfpaf:	NFPA Fire Rating
nfpah:	NFPA Health Rating
pc:	Critical Pressure
pvap:	Vapor pressure
rfi:	Refractive Index
rhol:	Liquid Density
rinpol:	Non-polar retention indices
ripol:	Polar retention indices
srf:	Surface Tension
tb:	Normal Boiling Point Temperature
tc:	Critical Temperature
tf:	Normal melting (fusion) point
vc:	Critical Volume
zc:	Critical Compressibility